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Ironfounding in the Dominions

Papers recently received from the Dominions throw much additional light on the progress being made in Canada, Australia and South Africa in grey-iron foundry practice. It is clear that the work of the Institute of British Foundrymen and the American Foundrymen's Association has been the major force in educating the peoples of the Dominions as to the potentialities of cast iron, whilst the nickel interests and the Meehanite companies have often been the means of translating these notions into practice. Another factor, which has had but scant recognition in this country, is the excellent work done by the metallurgists associated with the blast-furnace concerns. Canada now possesses two branches of the A.F.A., and its industrial and technical developments are of the same order as those of the United States. This is another way of saying that they are as highly developed as those of the mother country, especially in so far as it relates to mechanisation. Their "star" railway foundry is probably in advance of anything in this country. Conditions in Australia are particularly interesting; it is obvious that very extensive developments are in progress, and not the least important is use of direct metal for the making of large castings, such as 65-ton ingot moulds. The unbiased metallurgist will, we are sure, agree with us that, when treated with soda ash and mixed with cupola metal, liquid pig-iron of controlled composition is easily capable of yielding excellent heavy castings. Through the local manufacture of foundry plant and testing apparatus, coupled with the existence of an abundance of adequate raw materials, Australia is now practically self-sufficient as a modern ironfounding community. Whilst the country possesses foundry technicians of international reputation, these are apparently insufficient to meet the growing demand.

South Africa has made astonishing strides, due in a large measure to the activities of the members of the South African Branch of the Institute of British Foundrymen, who have exhibited a commendable co-operative spirit for solution of individual problems. The Rand foundries, though located a thousand miles from the seaboard, have carried out, expeditiously, important jobs for the Navy and Mercantile Marine. They have made a start with foundry mechanisation, despite the fact that they can draw upon relatively cheap native labour as helpers. Moulding machines have been imported from, *inter alia*, Australia, as the foundry equipment trade is still only in its infancy, but is rapidly growing. By a recent mail, we received a photograph of a consignment of machinery made in Johannesburg and destined for Rochdale! As in Australia, all the necessary raw materials exist for the creation of a large ironfoundry industry, and the Iscor is playing the same important role in South Africa as does the Broken Hill concern in the Antipodes. It is obvious that Mr. Percy Pritchard had these factors well in mind when he addressed the annual meeting of the British Cast Iron Research Association, for by logical deduction he rightly stressed that the major advantage resting with the Mother Country was its research potential. True, research results are the most easily exportable commodity, but where reinforced by a well-equipped and intelligently directed development department, the advantage must lie with the originating country. To interest the great Dominions in our products, they must always be technically superior and cheaper than competitive plant obtainable either locally or from other markets. This country has learnt much about quantity production since 1939, and this knowledge, backed up by scientific industrial research, must be exploited to the full if British industry is to have an adequate share in the world's markets.

Contents

Ironfounding in the Dominions, 1.—New Year Honours, 2.—Electric Furnaces in the Manufacture of High-Duty Cast Iron, 3.—Correspondence, 8.—Double or Twin Patterns, 8.—Iron, Manganese and Sulphur, 9.—Chemical Analysis by X-ray Diffraction, 10.—Foundry Economies and Wartime Substitutes, 11.—India's Industrial War Effort, 12.—A New Type of Crucible Furnace, 13.—Hale & Hale (Tipton), Limited, 14.—Amalgamation of Enamelling Firms, 15.—Personal, 15.—News in Brief, 18.—Obituary, 18.—Iron and Steel Control, 18.—Simplification of Hearth Furniture, 18.—Raw Materials from North Africa, 18.—Company News, 20.—New Companies, 20.—New Patents, 20.—Raw Material Markets, 22.

NEW YEAR HONOURS

The names of many people associated with the iron and steel and heavy industries generally, appear in the New Year Honours List. Below are the chief awards, together with brief biographical details.

KNIGHTS BACHELOR

MR. ALEXANDER DUNBAR, Controller General, Ministry of Aircraft Production. He is a director of British Acheson Electrodes, Limited, Darlington Forge, Limited, English Steel Corporation, Limited, Firth-Vickers Stainless Steels, Limited, High Speed Steel Alloys, Limited, Industrial Steels, Limited, Steel Manufacturers Nickel Syndicate, Limited, Taylor Bros. & Company, Limited, and Vickers-Armstrongs, Limited. Mr. Dunbar has been director in charge of Vickers-Armstrongs' aviation interests since 1938. He joined Vickers, Limited, in 1904 and has served in all parts of the Vickers group.

MR. SUMMERS HUNTER, Regional Director, Merchant Shipbuilding and Repairs, North-East of England. He is managing director of Richardsons, Westgarth & Company, Limited, North-Eastern Marine Engineering Company (1938), Limited, and George Clark (1938), Limited, chairman of the British Perlit Iron Company, Limited, and of the Marine Oil Engine Development Syndicate, Limited, and a director of Richardsons, Westgarth-Brown Boveri, Limited, and John Dickinson & Sons, Limited.

MR. GEORGE KENNING, for public services, Derbyshire. He is chairman and managing director of Kennings, Limited, motor and agricultural engineers, and is a member of the Derbyshire County Council. Mr. Kenning is a member of Sheffield University Applied Science Committee.

MR. WILLIAM MURRAY MORRISON, vice-chairman and managing director of the British Aluminium Company, Limited, and of the North British Aluminium Company, Limited. He is chairman of Aluminium Sulphate, Limited, British & Colonial Bauxite Company, Limited, Imperial Magnesium Corporation, Limited, and Magnesium Metal Corporation, Limited, and is a member of the boards of Alliance Aluminium Holdings, Limited, James Booth & Company (1915), Limited, South Wales Aluminium Company, Limited, and other companies. Mr. Morrison was instrumental in establishing three big hydro-electric plants in the Highlands for the production of aluminium.

MR. GEORGE HORATIO NELSON, for services to the Ministry of Aircraft Production and the Ministry of Supply. He is chairman and managing director of the English Electric Company, Limited, chairman of the English Electric Export & Trading Company, Limited, and a director of Associated Manufacturers of Electric Traction Equipment, Limited, Micanite & Insulators Company, Limited, Power & Traction Finance Company, Limited, and Power & Finance Traction Company (Poland), Limited.

MR. WILLIAM MILES WEBSTER THOMAS, vice-chairman, Morris Motors, Limited, and subsidiary companies. He is chairman of the Cruiser Tank Production Group and a member of the Advisory Panel on Tank Production.

MR. ARTHUR BENEDICT WINDER, director and general manager of the English Steel Corporation, Limited, Darlington Forge, Limited, and Industrial Steels, Limited. He is a director of the Brearley Ingot Company, Limited, Firth-Vickers Stainless Steels, Limited, High Speed Steel Alloys, Limited, Oughtibridge Silica Firebrick Company, Limited, and Vickers-Armstrongs, Limited.

ORDER OF THE BRITISH EMPIRE

G.B.E.

COL. SIR (WILLIAM) CHARLES WRIGHT, Bt., Controller, Iron and Steel, Ministry of Supply, until illness led to his resignation and who has just agreed to assume the position of Acting Controller. During the last war he held the position of Controller of Iron and Steel Production, Ministry of Munitions of War. Sir Charles was president of the Iron and Steel Institute, 1931-33, and president of the British Iron and Steel Federation, 1938-38. He is chairman and managing director of Baldwins, Limited, and certain subsidiary companies, and of Guest Keen Baldwins Iron & Steel Company, Limited, and certain subsidiary companies, and a director of African Metals Corporation, Limited, Beaufort Works, Limited, Elba Tinplate Company, Limited, Great Western Railway Company, Oxfordshire Ironstone Company, Limited, and other companies.

K.B.E.

SIR FREDERICK JOSEPH WEST, chairman, North-West Training Committee, Ministry of Labour and National Service. He is chairman of West's Gas Improvement Company, Limited, and is also on the board of the Iron Trades Employers' Insurance Association, Limited, and the Manchester Ship Canal Company, of which he is chairman. He is a past-president of the Manchester Association of Engineers, and has been twice president of the Manchester Engineering Employers' Association, while he is also a past-president of the Manchester Engineering Council.

C.B.E.

LT.-COL. W. J. KENT, County A.R.P. Controller, Staffs. He is chairman and a managing director of Taylor, Tunnicliff (Refractories), Limited, chairman of Taylor, Tunnicliff (Electrical Industries), Limited, Electric Transmission Company, Limited, and Electric & Ordnance Accessories Company, Limited.

ORDER OF THE INDIAN EMPIRE

C.I.E.

MR. R. A. MACGREGOR, chief metallurgist, Department of Supply, Calcutta.

Absenteeism in 1942 will have cost American war industry 121,000,000 man-days, the equivalent of $1,000,000,000 in wages to war workers, stated Dr. V. G. Heisen to the National Association of Manufacturers' Committee on Healthful Working Conditions.

ELECTRIC FURNACES IN THE MANUFACTURE OF HIGH-DUTY CAST IRON*

By T. R. TWIGGER

Principal Factors Covering Selection and Operation of these Furnaces Indicated by Personal Experiences

The object of this Paper is to record some personal views and experiences covering the application of electric furnaces in the manufacture of high-grade cast iron, and to indicate the principal factors governing the selection and operation of such furnaces. It should be made clear that the operating conditions in the author's works are different from those obtaining in many foundries, as the system of furnace operation has been arranged to give not only economical operation of the furnace itself but economical operation of the unit of which it forms a part.

Previous Institute Papers

Although Papers on the use of electric furnaces for cast iron were read in this country and America in 1919, that given by G. K. Elliott to the Institute's Annual Conference in 1921 is the author's recollection of the earliest Paper on the subject, and it well merits reading or re-reading by those interested. Progress has been such that there must now be few instead of many who "look upon the occasional adoption of the electric furnace for such common material as cast iron as either foolish extravagance or metallurgical affectation." Elliott's work referred chiefly to a basic-lined furnace on account of its cleansing, degasifying, and sulphur reducing possibilities. A Paper on "Electric Furnaces in the Foundry" was given to this Branch of the Institute by D. Wilkinson in 1921. This Paper, like that of Elliott, emphasised the advantages of duplexing, thus retaining the low melting cost of the cupola, but Wilkinson considered the basic furnace useless when used intermittently—possibly owing to the unsatisfactory basic lining materials then available. Curiously enough Wilkinson's Paper gives a hypothetical scheme for cupola/electric duplexing, very similar to that in operation in the author's works. A very comprehensive and recent review of electric furnaces operating on cast iron is given in Robiette's book: "Electric Melting Practice."

* A Paper read before the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen.

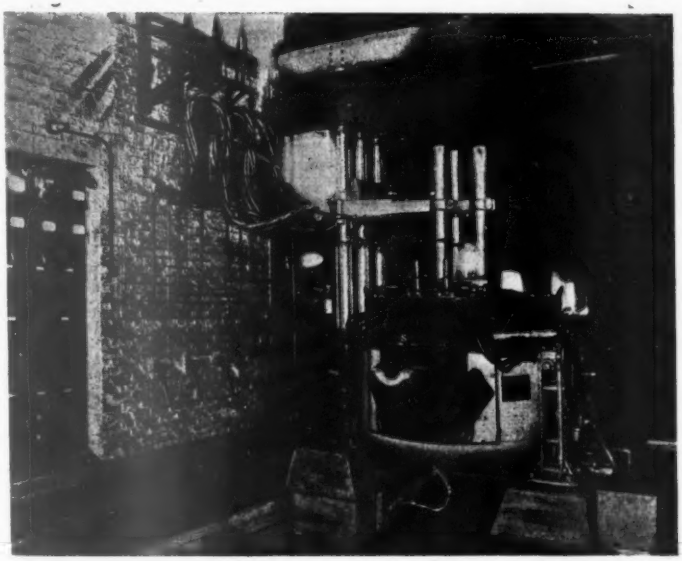


FIG. 1.—'LECTROMELT FURNACE AS USED FOR MAKING HIGH-DUTY CAST IRON.

There can be no doubt that the development of cast iron in the direction of greatly increased strength—usually the result of reduced carbon content, or the addition of alloys, together with the necessity in many cases for high pouring temperatures—greatly widens the scope for electric furnace applications, although, except perhaps in one or two isolated cases, the cupola continues, and is likely to continue, to provide the bulk tonnage of normal grades of cast iron.

Factors Influencing Electric Furnace Application

Compared with normal cupola melting, the electric furnace will:—

(1) Produce to very close limits of composition with very low losses—a point of importance with expensive alloys.

(2) Produce low carbon and alloy irons of high strength

Electric Furnaces on High-Duty Iron

which it would be difficult, if not impossible, to produce in the cupola.

(3) Utilise scrap material of low market value such as turnings and borings, even though the excessive bulk of these materials compared with normal solid charges, limits the amount the furnace will hold.

(4) Superheat to very high temperatures should this be desired.

(5) Act as a receiver, maintaining molten metal temperature without serious change in composition unless held for an excessively long period.

(6) Under suitable conditions desulphurise, where this is necessary.

The electric furnace will not:—

(1) Melt normal grades of pig-iron and scrap at a cost comparable with that of cupola melting.

FIG. 2 (ABOVE).—RESISTANCE-TYPE ELECTRIC FURNACES USED IN CONJUNCTION WITH THE CUPOLA FOR THE DUPLEX PROCESS.

FIG. 3 (LEFT).—THE BIRLEC-DETROIT FURNACE INSTALLED FOR THE MELTING OR DUPLEXING OF CAST IRON.

Electric Furnaces on High-Duty Iron

(2) Provide a continuous supply of molten metal over a normal working day unless operated on the basis of first melting a cold charge and then adding cold metal and withdrawing molten metal at regular intervals; obviously the throughput in such a case would be somewhat limited.

A point worth noting is that unless precautions are taken, electric furnace metal, possibly on account of the high temperature conditions prevailing, especially in the vicinity of the arc, may tend in small sections to solidify in the supercooled condition, giving a structure which for some purposes may be undesirable. A further point is that maximum economy of operation is only obtained by working 24 hrs. per day.

Types of Furnace Available

Direct Arc, usually 3-phase, with top electrodes and automatic electrode control except on the very small sizes. The larger furnaces may be arranged for top charging. Tilting may be either by hand on the smaller sizes, by motor, or by hydraulic pressure, and pouring can be effected either by tilting on a central axis or by lip pouring at a constant level. Such furnaces are eminently suited to the usual 3-phase supply. A typical furnace, shown in Fig. 1, with which the author is familiar is a 'Lectromelt "S" type having a nominal capacity 1,500 lbs. cold charge.

Indirect Arc.—A typical furnace (shown in Fig. 3) is the Detroit or Birlec-Detroit rocking arc. In such furnaces heating is effected by radiation from the arc and by conduction from the furnace wall. The temperature required for even low carbon cast iron is usually not sufficiently high to cause serious loss of life on the lining, which is a factor to be reckoned with when considering the use of small furnaces of this type for steel and other high melting point alloys. The Detroit type is a single phase furnace, and difficulty is sometimes experienced with supply authorities, unless the load can be balanced, as for example by using three furnaces. Personal experience of furnaces

FIG 4.—TAPPING THE CUPOLA-MELTED METAL INTO MONORAIL-SUSPENDED LADLES.

FIG. 5.—WEIGHING THE METAL EN ROUTE TO THE ELECTRIC FURNACE.

Electric Furnaces

for 350 lbs. cold charge or 500 lbs. molten, operating on low alloy irons, and also on austenitic iron of the Ni-resist type, has been very satisfactory.

Induction Furnaces.—These are very efficient melting furnaces, but of very high capital cost. They are finding increasing application for high-grade steels, but although economic in operation due to the absence of electrodes, low refractory costs, etc., their technical advantages are not generally of such attraction on cast-iron alloys as to overcome the objection to the very high capital cost.

Resistance Furnaces.—Considerable use is made of furnaces having a central carbon resistor. The writer has no personal experience of this type of furnace, but has been informed that the furnace, shown in Fig. 2, is considered quite satisfactory on cast-iron alloys, including the Ni-resist type of material.

FIG. 8.—FEEDING THE SPINNING MACHINES.

FIG. 6.—TEEMING THE METAL INTO THE ELECTRIC FURNACE.

FIG. 7.—TAPPING THE ELECTRIC FURNACE WHICH IS FITTED WITH A SLAG-TRAP SPOUT AS SHOWN IN FIG. 9 (SEE DISCUSSION).

Electric Furnaces on High-Duty Iron

In the works with which the author is connected electric furnaces have been utilised chiefly for modifying and alloying cupola metal for special purposes, in connection with a centrifugal casting foundry which must of necessity operate on a continuous basis, involving a continuous supply of molten metal over a 9-hr. shift. Although careful attention is given to maximum economy of furnace operation, the overall efficiency of the complete production unit is of prime importance. For example, it would be preferable to have the electric furnace metal ready a short time before required, and use current to keep the metal hot rather than have a number of casting machines and operators waiting for metal.

Two principal methods are in use:—

(1) Production of molten metal, either from a cold charge, or more often modifying cupola metal of such a composition that the desired final composition can be achieved by using a percentage of the special electric furnace metal with the balance of cupola metal. This is the method usually practised with the rocking arc furnace. Since the supply must be continuous, two electric furnaces must be used, or alternatively when using one electric furnace the metal may be stored in a crucible furnace. This method is regularly used for austenitic cast iron of the Ni-resist type, the final mixture consisting of 50 per cent. cupola metal with 50 per cent. electric furnace metal. Table I represents a typical charge.

The advantages of this particular scheme can be detailed as under: (*a*) It is possible to obtain a large output of any special composition that may be desired from a relatively small amount of special alloy iron, and (*b*) the cupola may be kept continuously melting one standard mixture, thus avoiding special charges which it is difficult—and in some cases impossible to keep separated. When using this method it is, of course, necessary to exercise very close control over the relative weight of the two different mixtures, although under some conditions measurement in a ladle can be relied upon. In view of the ever-increasing tendency for continuous plant operation, it is thought that this method offers considerable scope for accommodating castings which require special provision as regards composition.

(2) Continuous Duplexing of Molten Cupola Metal.—In this case molten metal, as near as possible to the desired final composition, is melted in a cupola, and transferred at 10-min. intervals to a 'Lectromelt furnace in which a 7-cwt. cold charge has already been melted. Alloy or steel additions as necessary are made, and the metal withdrawn usually at 10-min. intervals for casting. With the system of continuous duplexing already described the handling of the molten metal into and from the furnace needs careful consideration. Cupola metal is tapped into a 2½-cwt. ladle (see Fig. 4), which is transported by monorail to the 'Lectromelt furnace, passing en route over a section of the monorail connected to a weighing machine (Fig. 5). The weight over or under the nominal 2½ cwts. is recorded on a board, which is inspected by the control metallurgist at frequent intervals. In this way correction can be made if necessary to the weight of steel, alloys, etc., being added to the furnace. Actually in practice the need for adjustment is very small. The metal is added to the electric furnace through what is normally the tapping spout (Fig. 6), and is withdrawn by pouring into a runway ladle (Fig. 7) for transportation to the casting machine, direct pouring into the runner basin being effected from the conveyor ladle (Fig. 8); in this way no metal is carried by hand.

(To be continued)

TABLE I.—*Electric Furnace Charge Sheet.* October 12, 1942.

Cast No. Z.8. *Centrifugal Foundry. Furnace No.* 3 (*Rocking Arc*).

Mix. No.	Charge.	Alloys, etc.	Time start.	Time charged.	Time tapped.	No. of charges.
8 Alloy	148 lbs. alloys	Nickel .. 86 lbs.	1st charge, 7.0	7.30	8.30	—
	22 „ steel	Fe-Chrome .. 21 „				
	130 „ cup. No. 8 (molten) ..	„ Phos. .. 5 „	Meter	Meter	Meter	4½
	300	Copper .. 36 „	897,100	897,150	(1st charge) 897,370 (last charge)	

Above used with equal weight of Cupola Mixture No. 8.

		T.C	Si	P	Mn	Ni	Cr	Mo	Cu
8 alloy mixed 50 per cent. with No. 8 cup.	Com. cal.	1.82	1.75	0.77	0.50	27.8	4.93	—	12.0
	Assumed loss	0.02	0.06	—	0.05	—	0.10	—	0.10
	Com. expected	2.57	1.92	0.84	0.60	14.0	2.49	—	6.0
	Com. actual	2.61	1.90	0.84	0.62	14.12	2.40	—	6.17

Average current consumption 450 units per ton.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

CUPOLA MELTED HIGH-DUTY IRONS

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—We have been much interested in the most informative articles you have published on "Cupola-Melted High-Duty Cast Irons," by Mr. W. W. Braidwood, and the space you have given this Paper is surely thoroughly justified.

Our experience may add a little.

On page 69 of your issue of May 14, 1942, mention is made that carburisation takes place almost entirely after the steel has become molten.

It has been noted that, in the case of a cupola being dropped, for some reason, while still charged with steel scrap, the pieces of scrap from the melting zone, if broken, will be found white on the edges of the fracture; and to appear carburised, if only to a depth of $\frac{1}{64}$ in., but, as this $\frac{1}{64}$ in. completely surrounds the piece of scrap, it would seem that before the drop of metal parts from its parent piece it has definitely become carburised before melting.

We have been melting silicon and scrap steel for about 18 years, not for high-duty irons, but for converting into steel. In Australia our coke is high in ash, 14 to 20 per cent., and our practice is to use, in a parallel sided cupola lined to 33 in., tuyeres 20 in. from bottom, six in number, 6 in. by 5 in. flared to 14 in. by 2½ in., 11 cwts. of coke on bed, and 1¼ cwts. of coke per charge of 8 cwts. steel scrap, plus 10 lbs. of 75 per cent. silicon.

The blast pressure is 14 in. water column, and we manage fairly comfortably to melt daily 4 tons of iron for ingot moulds, followed by 12 tons of the silicon and steel mixture; provided the scrap is not thinner than, say, ¼ in. If the scrap is thinner, we get trouble with bad slag and dull metal.

For conversion to steel we desire to raise the carbon content as much as possible, in order to get more heat units in our converter, but we think, due to high ash coke, we cannot get a higher carbon content than 2.5 per cent.; in fact, our average is 2.2 per cent. carbon in the metal tapped.

Our chief difficulty is the lining, for with this almost all-steel scrap mixture, we required to re-brick the melting zone each week in spite of daily patching.

Yours, etc.,

P. DAVIES
(For Davies & Baird Pty., Ltd.).

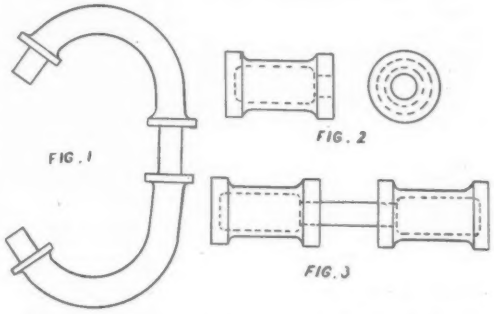
Davies & Baird Pty., Ltd.,
15, Brunswick Road, Brunswick, N.10,
Melbourne, Victoria, Australia.

The West Riding of Yorkshire Branch of the Institute of British Foundrymen is organising a short Paper competition limited to 1,000 words for the March 13 meeting. Only members of the Branch may compete and entries must reach the honorary secretary before January 30.

DOUBLE OR TWIN PATTERNS

By "CHECKER."

It sometimes happens that the shape of a pattern and core is such that by making a double or twin pattern, the setting of the core in the correct position will be simplified. Fig. 1 shows a small bend which was made in this manner, and although it could be made a single pattern, the setting of the core to get an even thickness of metal would not be so reliable as when made a double pattern with the core well balanced at the two ends and in the middle.



With patterns of this type, it is advisable to make them in halves to simplify making the joint in the mould, and if necessary they can be put on plates for machine moulding. Either a full corebox can be made, or one-half only from which the half cores are made, dried, and gummed together; in both cases the corebox is constructed to core out for both patterns.

Sometimes the shape of the casting is such that a long print at one end would be required to balance the core as shown in Fig. 2, but by making a double pattern with a print between as shown in Fig. 3, the difficulty of setting the core is mainly overcome, care being taken to make the print long enough to allow the core to have a firm and satisfactory seating between the two patterns.

Chicago Magnesium Foundry

The world's largest magnesium foundry, with an anticipated monthly production of over 250 tons of castings, is now nearly completed. It has been built by the Howard Foundry Company. Processes have been developed for making magnesium castings of a size much larger than have been hitherto commercially practical. Single castings up to 7 and 8 ft. in dia. will be included as part of the normal output.

Fluxes.—Multiple Acting Flux, Limited, of 8, Ashgate Road, Sheffield, 10, have used an eight-page leaflet to report results given by the proprietory fluxes they have developed.

IRON, MANGANESE AND SULPHUR

DISCUSSION OF MR. OLDERSHAW'S PAPER

At the opening meeting of the 1942-43 session of the West Yorkshire Branch of the Institute of British Foundrymen, MR. F. OLDERSHAW, of Wakefield, after giving his presidential address (reported in the JOURNAL of October 29, 1942), again presented the Paper on "Iron, Manganese and Sulphur," read at the last meeting on April 25, 1942. The Paper was published in THE FOUNDRY TRADE JOURNAL of June 4, 1942. During delivery of the President's Paper, Mr. L. Turner, Senior Vice-President of the Branch, presided.

In the course of the discussion, MR. OLDERSHAW, replying to a query by Mr. G. W. Nicholls, said he did not think the point with regard to the amount of sulphur and manganese mattered as much as the questioner indicated. In the paragraph concerned, he (the President) had been dealing with hardening effects. It had been proved that the sulphides helped, because they gave a close matrix, but if it were known that the sulphur was high, it was necessary to increase the silicon to get the necessary graphite formation, otherwise machining difficulties would arise. He agreed with Mr. Nicholls that there must be a balance with the manganese. With very low manganese and high sulphur there would probably be trouble.

Judging Metal from Appearance

MR. D. JEPSON asked to what extent was the judging of the metal from the appearance in the ladle made use of in actual practice.

MR. OLDERSHAW advised against this unless they were conversant with the effects and also the appearance. It might otherwise be misleading to judge the appearance of the metal in the ladle. He would certainly not discard the analysis, but it was a rough guide for immediate working if one were familiar with it.

MR. J. BLAKISTON likened this to the practice of the judging of a metal by looking at the metal in the "risers," which one sometimes hears referred to by the old practical moulder.

MR. OLDERSHAW said what he was referring to was the phenomena which occurred in the film on the surface of the molten metal. This was due to the effect of manganese, and in days gone by foundrymen looked for this "flowering" on the top of the ladle. When this was very marked, the metal looked well and would run well, and was therefore considered to be good metal, but since those times more has been learned about cast iron, and it is now known that its appearance did not tell the whole of the story.

MR. W. G. THORNTON asked whether the lecturer associated high carbon with high manganese. From his (the speaker's) experience he could hardly agree with that. He had used much higher manganese than that mentioned and much lower silicon, and had no difficulty in bringing down total carbon.

MR. OLDERSHAW stated that his remarks referred more to the blast-furnace products than to cupola-melted iron. In ordinary pig-iron, where the manganese was low, there was more likely to be lower carbon. With high manganese the carbon was protected, due to the manganese having a greater affinity for carbon than had iron, and also to the fact that manganese protected the carbon by combining with oxygen present.

MR. THORNTON agreed, provided the reference was to the blast furnace.

Sulphur by Volumetric Analysis

MR. J. STOTT remarked that mention had been made of the volumetric method of analysis for sulphur, and thought that this method was now out of date in up-to-date laboratories.

MR. OLDERSHAW, in reply, said that he was conversant with the up-to-date method which Mr. Stott had in mind, but he still thought the volumetric method quite good if properly carried out and the iodine solution handled in an efficient manner It was possible for misleading results to accrue if the sample was contaminated by the presence of copper.

In answer to queries by Mr. Nicholls and Mr. H. Balme, MR. OLDERSHAW suggested that, with cast iron, where sulphur and manganese were present, some sulphur would be found as manganese sulphide and some as iron sulphide, and even with a very high percentage of manganese some iron sulphide would persist.

MR. NICHOLLS said that, according to Stead, there must be an excess of about eight times the amount of manganese theoretically required to combine with the sulphur, if iron sulphide was to be minimised.

MR. OLDERSHAW stressed the point that it was good policy to have the sulphur present as manganese sulphide rather than as iron sulphide, because it was not so dangerous from a strength point of view.

A MEMBER referred to the difficulty experienced with the "first and last" iron tapped from the cupola, and MR. OLDERSHAW said that, if this could be eliminated, much trouble would be avoided.

MR. BLAKISTON said that this iron should be "pigged down."

MR. POTTER asked whether, when making pressure castings, high sulphur might tend to make the metal close, and was that likely to be good in everyday practice? Was it not asking for trouble in other directions?

MR. OLDERSHAW replied that 0.15 to 0.20 per cent. would induce a close metal and would not cause trouble, providing the other elements present were in balance. With low silicon, excessive shrinkage and contraction would occur, and if these percentages were exceeded, it would tend to reduce strength.

MR. BALME asked whether the lecturer thought that high manganese content had any ameliorative effect on the trouble experienced through gas-holes.

MR. OLDERSHAW thought that, with a fair amount of manganese present, there was a tendency to reduce the formation of gas-holes. Manganese purged the metal, acting as a deoxidiser, and did tend to exclude gases. It was not necessary to add manganese excessively, but if it was reasonably high, it did help to get rid of oxides and gas-holes. It was a very useful scavenger, providing the correct temperature was used.

MR. R. OLDERSHAW (Halifax) asked whether sulphur

Iron, Manganese and Sulphur

was detrimental to cast iron, and in what way would it affect the strength on test?

The PRESIDENT said that, with very low sulphur, there would be an alteration in the graphitic formation, and up to a certain point sulphur was not detrimental. If the sulphur was low, the silicon could be reduced and thereby good test figures could be obtained. Excessive sulphur was not desirable and the strength should be regulated by the silicon and not by increased sulphur. One was a palliative whilst the other was the proper procedure.

Vote of Thanks

MR. BLAKISTON, proposing a vote of thanks to the President, said he felt the old foundryman was needlessly afraid of sulphur and its effects on the casting, because he did not know how to handle it. Nowadays, foundries were getting very sound castings with higher sulphur simply because they mix it with a proper manganese content and use it at the proper temperature. He maintained that sulphur was beneficial to a casting, so long as it was used wisely. Not only did it increase the tensile strength, but it produced a metal which had considerable resistance to wear. Under present war conditions, foundrymen would have to contend with manganese to an undreamt-of extent because the industry had to use so much steel scrap, which had of itself a good proportion of manganese, and with that added to the manganese in the pig-iron it would tend to produce a metal which was almost unmachinable, unless it could be moderated with sulphur. Mr. Oldershaw had gone a long way towards showing how the compound was formed, and his Paper should be taken very much to heart by everybody.

MR. THORNTON, seconding, said there was no doubt that there was a tendency to get scared of sulphur about ten years ago. The President had stressed that there was no need to be afraid of it, and he (Mr. Thornton) fully agreed.

(*Concluded from next column.*)

the card index the identity of the unknown elements can be established if the patterns of the components are included in the index. The detection of minor constituents is usually not possible if the concentration of that constituent in the mixture is less than about 10 per cent. This is a disadvantage in some cases but in other cases, where the interest is mainly in identifying the major constituents, the interpretation of the pattern is much simpler and more certain than it would be if the patterns of all the very minor phases were also present in the X-ray photogram.

Most applications of the X-ray method in industry have been in the field of qualitative analysis, for which the method has many unique applications. In very special cases a semi-quantitative analysis can be made with the aid of synthetic comparison standards.

CHEMICAL ANALYSIS BY X-RAY DIFFRACTION

Ever present problems in the metallurgical and chemical industries are those of chemical analysis and the identification of materials, points out M. L. FULLER in "The Iron Age." Supplementing the classical methods of chemical analysis, various new methods such as spectrographic analysis, electrometric analysis, microanalysis, and X-ray diffraction have been adopted. While many of these new methods give the same type of information as obtainable by the older methods, the X-ray diffraction technique, in special applications, yields knowledge concerning the composition of a material that is unobtainable or difficult to obtain by other methods. The special value of the X-ray method lies in its ability to detect and identify chemical compounds or alloy phases.

Nature of X-ray Diffraction

In taking X-ray diffraction photographs a beam of X-rays is allowed to strike the specimen undergoing examination in a special camera, arranged to record the X-rays that are reflected by the specimen. From an optical standpoint, this phenomenon is known as diffraction, the specimen acting as the diffraction grating and the photograph obtained being the diffraction pattern. Each element, chemical compound, and alloy phase has its characteristic diffraction pattern by which its presence in a material can be established. When more than one constituent is present, the resulting photograph consists of the patterns of all constituents superimposed.

The distinctive feature of the X-ray diffraction method of analysis is that the chemical compounds present in the unknown material are identifiable, whereas, in ordinary chemical analysis usually only the constituent element can be determined. This may be illustrated by a hypothetical case. A sample is analysed in the chemical laboratory and reported as 24.3 per cent. FeO, 20.4 per cent. SiO_2 and 55.3 per cent. ZnO. These results do not indicate whether the sample is a mixture of FeO and Zn_2SiO_4; ZnO and $FeSiO_3$; Zn_2SiO_4, $FeSiO_3$, ZnO and FeO; or FeO ZnO and SiO_2. Supplementing the usual chemical analysis with an X-ray analysis would indicate exactly what compounds are present.

A.S.T.M. Diffraction Data Index

The importance of the X-ray diffraction method to industry is indicated by the fact that the American Society for Testing Materials, in co-operation with the National Research Council, has recently published the X-ray diffraction pattern data for some 1,300 elements and compounds. This information is printed as a card index comprising about 4,000 cards, and is classified according to the positions of the three strongest lines of the patterns of each element and compound.

In analysing an unknown material the X-ray diffraction pattern is photographed and the line positions and relative intensities are measured. By reference to

(*Concluded in previous column.*)

FOUNDRY ECONOMIES AND WARTIME SUBSTITUTES

SHEFFIELD BRANCH DISCUSSION

The October meeting of the Sheffield Branch of the Institute of British Foundrymen was devoted to a discussion on "Foundry Economies and Wartime Substitutes." It was opened by MR. T. R. WALKER, who referred to the successful substitution of the British material, fuller's earth, to replace the American clay, bentonite. Before the war 9,000 tons of bentonite were imported annually, at the present time this figure would have been increased to 15,000 tons per annum. Fuller's earth is the nearest British substitute for bentonite. It is three-quarters as good from a green strength point of view; it is not quite so refractory, and has a slightly shorter foundry life. It is necessary to use 5 per cent. of the new clay instead of 3½ per cent. bentonite, and, when reclaiming, one has to take out more clay and put more new clay into the system sand. Fulbond No. 1 is the natural fuller's earth, specially dried and ground; Fulbond No. 1A is a similar clay from another deposit, but is not as good as the No. 1. Fulbond's Nos. 2 and 3 are clays which have been specially treated with sodium carbonate, which takes out some of the calcium and replaces it with sodium, and that is why Fulbond's Nos. 2 and 3 have considerably higher green strength than Fulbond No. 1 or 1A. The extra treatment costs about £3 per ton. Bentonite is an extremely fine grained material, it is naturally fine grained and therefore only a light milling is sufficient to develop its full strength in sand mixtures. With fuller's earth one must use a heavier mill and increased milling time.

Colbond is a clay which occurs alongside silica flour in the Irish Free State. It has lower green strength than fuller's earth but is more refractory. Different clays can be mixed together, for example ball clay and fuller's earth can be mixed to give almost any green strength/dry strength ratio, but one must use heavy mills—ordinary mixing is useless.

Core Economies

Regarding core sands, oil sands are widely used for core making for a number of reasons, such as: (1) collapsibility; (2) to make stand-by cores to keep the coremakers fully employed; (3) inserts for tops of runners and other little jobs for many of which one could use green sand or dry sand mixtures. Considerable economies can be made in the amount of core binders used in the core-sand mixtures. Some foundries use 5 per cent. or more of core binders; some of Mr. Walker's cores show strengths of ¼ ton per sq. in. To save trouble one core mixture is often made for many cores, large or small. One could reduce the amount of core compound for smaller cores. The amount of compound is fixed by the largest core regularly made.

There is a considerable wastage of core compounds by guessing the amount of additions. Men usually guess on the top side; liquid binders should be measured and the sand or compounds carefully weighed into the mixer. Hot sand wastes core compound, and by the time it has been on the core bench half an hour it is nearly ruined. Drying out can be prevented by covering with damp sacks. The dextrine percentage can be reduced by using silica flour or clay, which will give green strength but will reduce the dry strength. In the case of silica flour, the core is still collapsible. If you do not require collapsibility, use clay and not silica flour.

The core creams (which contain less dextrine) should be used instead of semi-solid material to save dextrine. Attention should be given also to the baking conditions; overbaked and underbaked cores are deficient in strength. Economy in the use of acetylene is being obtained by the use of "Pyro-gas," which is a British product. It will cut off risers and runners. It takes a little longer to start a cut, but once the cut has started, it is the oxygen which does the cutting. Pyro-gas will cut through a 12-in. plate.

Fuel Economy

Fuel economy has been to the forefront lately, and in view of the previous economy the new cut of 7½ per cent. takes a lot of meeting. His concern had to save 750 tons of fuel per week. The salvage campaign is having good results. Grinding wheel stubs can be recovered, the stubs can be used again, and finally the material sent back to the manufacturers for making certain types of wheels. One can get up to £8 per ton for the stubs of used grinding wheels. Lifting irons are another source of waste. The bulk of them are no worse except that they are bent. They should be picked out and straightened. Finally, rubber boots can now be repaired locally.

Skin Drying Replaces Stoving

The discussion was continued by MR. W. H. SALMON, who referred to the substitution of British moulding and silica sands for Belgian yellow and Belgian silver sand. Fortunately many steel foundries had already found British sands that were suitable for their purpose. Probably the greatest economy in fuel consumption in the foundry had been made by the extension of the use of skin-drying instead of stove drying. Skin drying, either by means of gas flares or portable forced draft coke fires, was being successfully employed for even large steel castings; the sand was only dried for a few inches deep, and as the bulk of the sand and the moulding boxes were not heated there was a great saving in fuel.

The introduction of female labour into foundries had been an important contribution to the progress which had been made in war-time substitutes. Female coremakers could be trained to make a repetition core satisfactorily, and could give a high rate of production without becoming bored with the job. Women crane-drivers, too, were an asset. Women like repetition jobs but hate to be moved from one job to another, and so are not so adaptable when employed as foundry general labourers.

With regard to the restriction on the use of nickel in forged and rolled steels, exemplified by the standard

Foundry Economies and Wartime Substitutes

EN steels, while there was no official restriction yet on the use of nickel in castings, the steel foundries had already made a considerable economy in this direction. Designers, too, were economising in the use of steel castings where malleable iron or even cast iron could be used.

German Economies

MR. WALKER said that with regard to female labour, women differ from men in that they get on with the job as long as they can see something happening, something made or something altered. If they are put on a job where they cannot see any change it upsets them. Nervous breakdowns of women after 6 months of factory life have been traced to jobs where the woman has nothing to see for her efforts. He had recently read a German article on core-binders. In Britain we still get linseed oil, molasses and dextrine, all of which are foods. In Germany that has all gone, there is no linseed oil, no dextrine, no starch gums. The only things they have are sulphite lye and pitch. Pitch gives both green and dry strength, it is a viscous liquid or practically solid. When you heat it, you drive off the volatile matter and the sand mixture hardens. By taking various proportions of sulphite lye and pitch the Germans seem to be managing pretty well.

MR. TURVEY said that to get the same green strength with Fulbond it was necessary to use one and a quarter times the amount of bentonite previously employed. Did this reduce the permeability? Mr. Walker said that the extra amount of fines did reduce the permeability, and this point should be controlled, particularly in sand reclamation systems, where a greater amount of "fines" must be removed daily to keep the sand in proper condition. MR. SALMON confirmed this view, and said that he had found that the dust exhaust pipes had to be cleaned out more frequently now that he was using fuller's earth instead of bentonite.

MR. STEELE was recovering the bed coke from the cupola; it was broken to present a clean open face for burning, and was satisfactory even when down to pea-size for use in slow combustion stoves for heating the factory. He agreed that women did not like moving from one job to another; they felt slighted if they were moved off a job. For sticking cores together he had been successful in substituting raw sulphite lye for flour paste.

MR. BRITTAIN referred to the use of coal dust for iron castings, and wondered if at times the moulders used too much coal dust in their mixtures. Iron moulders also use machine oil on green sand moulds in front of the runners and on sharp edges, and he wondered if it was essential.

MR. STEELE said that the permissible amount of coal dust for iron castings depended on whether the casting had to be machined or not. Excessive coal dust gave blowholes. Regarding the use of oil on the face of moulds for cast iron, MR. TURVEY said it was used to prevent scabs, but there was a danger that excess oil would cause misruns.

MR. BRITTAIN referred to the shortage of Quebec pine and the difficulties entailed in the use of Western white pine, which is wet and more open than timber usually available for patterns. Even mahogany patterns warp in less than a week.

INDIA'S INDUSTRIAL WAR EFFORT

In the first year of the war, India executed war orders to the total value of £62¼ million. By the end of the second year, they rose to nearly £123 million, and as at July 31 last they totalled £273 million. War orders are now being placed at the rate of nearly £15 million a month.

The munitions output is many times pre-war capacity. More than £5¼ million have been spent on the expansion of ordnance factories and a further £12 million expansion scheme is already in hand. New types of shell, including 25-pounder, 3.7 in. anti-aircraft, various types of armour-piercing anti-tank shells and new types of guns, including the 3.7-in. anti-aircraft gun, are regularly in production. High explosives such as T.N.T. are manufactured at these factories for the first time in India. Large plants have now been installed for the manufacture of toluene, acetone, kieselguhr, mineral jelly and the various acids. India has also undertaken the manufacture of alloy steels. The manufacture of ferro-silicon has been established in one Indian works and at least half of India's requirements will be met from this source.

Increasing equipment and intensive training are turning out a new body of technicians, steelworkers, machine-tool workers, munition workers, engineers, chemists and many other trained personnel. At the outset of the war, there were about 600 trade workshops known to be available. The Directorate-General of Munitions Production is now using 1,500 engineering workshops—840 for general engineering items, over 300 for small tools and 345 plus 23 railway workshops for munitions components. Apart from establishments contracting direct with the Government, a very large number of small manufacturers are employed as sub-contractors. The capacity of a steel plate mill is to be extended by from 25 to 50 per cent. This mill supplies all the plate for shipbuilding repairs, and bullet-proof and other heavy armour steel.

Skoda, the Czech armaments firm, reports that in 1941 it was exclusively employed on armament orders for the Wehrmacht. The gross profit was 627.2 (396.6) million kr. in 1941 (and 1940); taxes and levies were 146.6 (74.7) million kr.; depreciation 180 (162.3) million kr., and social levies 203.9 (82.8) million kr.; leaving a net profit of 67.7 (63.7) million kr. A dividend of 6 per cent. was paid on the share capital, making 60 kr. per share against 64.80 kr. in 1940. Dividends in Bohemia and Moravia are now limited to 6 per cent.

A NEW TYPE OF CRUCIBLE FURNACE

The Morgan Crucible Company, Limited, of Battersea Church Road, London, S.W.11, announce the introduction of a new type of coke-fired crucible furnace, which is designed to overcome the short supply of fuel oil and town's gas. Known as Type "CCA," it is of the central axis type, and is made in five sizes, ranging from 150 lbs. to 10 cwts. (brass capacity). This type, which is a modernised version of the popular Morgan's type "S" tilting furnace, is fitted with salamander crucibles, as is shown in Fig. 1.

The furnace body has been extended so as to contain both crucible and muffle ring. The swinging preheater section is omitted, and the metal can be poured either through the crucible spout or over the top edge of the crucible without uncovering the combustion chamber. As a result, this furnace can be operated without undue loss of heat and under improved conditions for the personnel.

The furnace is self-contained, and constructed with the axis of tilt passing through the centre of the furnace, and is provided with suitable operating platforms and ladder. The furnace is for erection on ground level, and the molten metal is teemed into large or small ladles for conveyance to the moulds.

All the sizes are suitable for melting aluminium and aluminium alloys, brasses, copper, gunmetal, bronze, aluminium bronzes and brasses. Sizes up to No. 3 are suitable for melting up to 450-lb. charges of grey cast iron or low temperature alloy cast irons. For piston ring or other light castings demanding high temperatures, the type "S" furnace fitted with a preheater section is recommended.

All the main constructional details of the furnace design are indicated in the sectional elevation (Fig. 1), which also includes a referenced list describing individual details. For the duration of the war, refractories referenced "R" and "S" are replaced by plain circle bricks similar to those referenced "Q."

Working Results

The following is an extract from results recorded of trial melts carried out at Battersea with size No. 3 furnace, fitted with crucible TP.902 (pour-over-the-top) 550 lbs. brass capacity, and using "Bear Park Branceforth" coke. The average fuels quoted include the first heat:—

	Brass.	Copper.	Cast iron
Charge in lbs.	550	550	452
1st heat, min.	90	105	150
Sub. heats, min. ..	70	90	120
No. of melts	4	3	2
Fuel consumption, per cent.	16	20	33

When taking into account the extra weight of charge that can be melted in a pour-over-the-top crucible and the number of melts that are possible when the furnace is operated for a full 8-hr. day, the figures recorded are considerably better than those possible with tilting furnaces fitted with spouted crucibles.

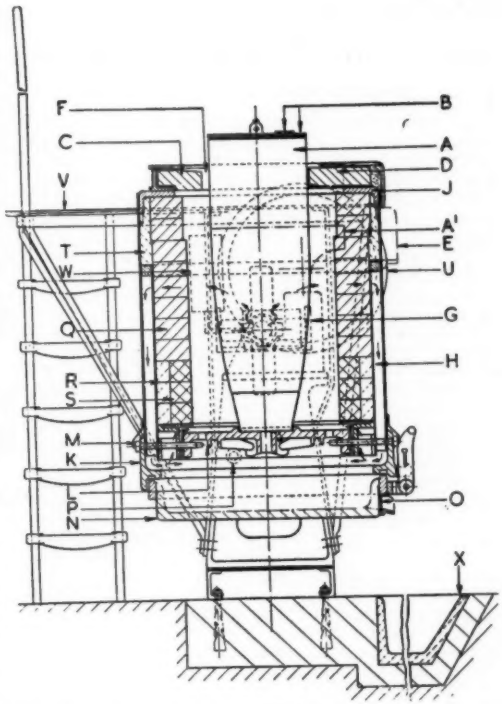


FIG. 1.—TYPE "CCA" COKE-FIRED CRUCIBLE TILTING FURNACE, FOR 400 LBS., BRASS CAPACITY.

A.—Combined Crucible and Muffle Ring.
A¹.—Spouted Crucible with Muffle Ring (alternative to "A").
B.—Crucible Cover with sight hole.
C.—3 Segmental pivotted Covers for fuelling.
D.—3 Guide bricks for Crucible with cast steel holders and stops for Covers "C."
E.—Spout gap for pouring from spouted Crucible.
F.—Waste gas outlet.
G.—Air inlet, baffle and control.
AIR SUPPLY (marked →). The air circulates round the casing, being thus pre-warmed prior to its distribution over and through the fire-bars to the combustion chamber.
H.—Inner casing (detachable).
J.—Top ring (detachable).
K.—Bottom ring carrying asbestos joint for ashpan.
L.—Hinged Firebars in 3 sections. Cast iron centre and cast steel side sections.
M.—Five pins for supporting the firebars.
N.—Ashpan with joint ring and Tee Wedge fastenings.
O.—Cast steel drain spout with fusible plate.
P.—Mica covered hole for sighting into Ashpan.
Q.—High grade refractory circle bricks.
R.—High grade refractory backing slabs.
S.—Special circle bricks.
T.—Heat-insulating slabs.
U.—Handwheel for tilting gear.
V.—Operator's platform with hinged back sections.
W.—Air pressure water gauge.
X.—Pit for ladle and spilt metal.

Company Meeting

HALE & HALE (TIPTON), LIMITED

MR. W. EDGAR HALE'S SURVEY

The sixth annual general meeting of Hale & Hale (Tipton), Limited, was held at Dudley on December 29, Mr. W. Edgar Hale, J.P., T.C., M.I.Mech.E., M.Inst.F. (chairman and managing director) presiding.

Moving the adoption of the report and accounts for the year ended August 4, 1942, the Chairman said:—

"This is the Sixth Annual Meeting of the members of Hale & Hale (Tipton), Limited, and before proceeding to deal with the history of the past year I feel it is my duty to make reference to the remarkably fine effort that has been made by the whole of the staff and employees of the Company during the last year. I have no hesitation in saying that there is in my opinion no body of workers, performing either mental or physical work in any comparable undertaking, that are doing a finer job of work than everyone associated with your Company.

"Having the excellent opportunities that I do have of observing what is being done all over the country, I am tremendously impressed with the phenomenal results which have been achieved up to this date. One sometimes hears the "armchair critic" pointing out how much better the enemy on occasion does things, but they do not realise that in many instances they have had bordering on twenty years of opportunity to prepare, which was denied to the producers in this country. In many very important instances even processes in this country were not perfect, and in the course of three years those processes have had to be perfected, plant has had to be constructed, works built to receive it, and ultimately staffed and brought into production. One hears a lot about bustle elsewhere, but believe me there are very few instances of real bustle that compare in a superior way to what has been done in Great Britain during the last three years.

Many Problems

"During the course of the year your executive has been called upon to face up to many problems, the solution of which only lay in extending the manufacturing capacity of your Company, resulting in the purchase and lease of different properties. As the leases terminate at the end of hostilities, and for other reasons which you will understand, I do not propose to make reference to them.

"The only purchase of note, however, was the purchase of debentures and ordinary shares in Chatwins, Limited, Market Foundry, Tipton, which works has been engaged for many, many years on the production of grates and ranges from the days when what would be regarded as very crude equipment was required, right up to the present day, when a much more scientifically designed and constructed apparatus is in demand. Their production of domestic grates under the title of "Sunbeam," "Sunbeamette," and "Eezikleen," are well-known throughout the country. Your executives were anxious to secure additional foundry space, and these works lent themselves well to adaption to the requirements of your Company, and I am pleased to say that we have been in production there now for some time, and provided no unforeseen circumstances arise, month by month increased production will be forthcoming from these works.

"It is much to be regretted that as proprietors of the Company you are unable to receive virtually any financial reward from the work which your executive is putting into this and other problems, but I am sure you will agree with me unhesitatingly that the winning of the war is the problem of the hour, and that pecuniary gain for the individual must definitely take second place. For the first time on the assets side of the Balance Sheet there appears the debentures and the ordinary shares in Chatwins, Limited, at cost.

Purchase of Phœnix Foundry

"Since the accounts for the year were closed, negotiations have taken place and have been completed for the purchase of the assets of J. & J. Whitehouse (a firm), of Phœnix Foundry, Tipton, whose production hitherto has been devoted to the manufacture of cast-iron hollow-ware mainly for export to the tropical countries, and while the transaction will not appear in the accounts before next year, I am pleased to state that the plant has already been transformed and is well advanced in producing material of great national importance. The transaction will crystallise itself in a holding of ordinary shares in J. & J. Whitehouse (Tipton), Limited.

"I am pleased to be able to state also that your executives have been called upon on numerous occasions to advise various Government Departments and various contractors on what was considered to be advisable procedure in relation to important national matters.

"Turning now to the report and accounts, it will be observed, in comparison with last year, that very material changes have of necessity taken place.

"Dealing first of all with the net trading profit, as I have indicated, each year since modern taxation as we know it came into existence, the net amount of profit remains virtually the same, the Chancellor of the Exchequer taking all the surplus. It is only affected by certain percentage allowances which are available in relation to increased moneys involved in the operation of any particular enterprise. It will be observed, therefore, that the figure last year was £20,500, or thereabouts, and this year it is a little over £21,000. Depreciation to be charged against this figure is a little less than heretofore, and the resultant balance available is up roughly £1,000.

The Balance Sheet

"Referring now to the Balance Sheet. On the liabilities side it will be observed, into the general reserve account has been taken the additional amount voted to it last year, the same applying also to the reserve account for obsolescence of plant and

STANTON *Dale* REFINED PIG IRON

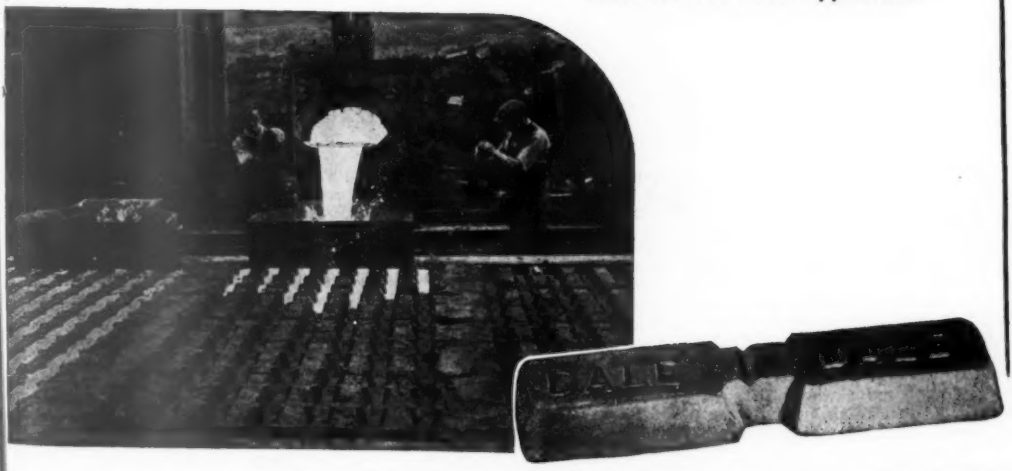
IS CHARACTERISED by closeness of grain structure, uniformity of composition and fine graphitic carbon evenly distributed.

IS PRODUCED to guaranteed analysis in seven standard grades.

CAN BE MADE to customers' individual requirements with total carbon from 2·6 per cent. upwards.

SHOULD BE USED to tone up high phosphorus irons and scrap, to replace Hematite, and to produce castings for all high duty purposes.

Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

Hale & Hale (Tipton), Limited

machinery. The taxation reserve account remains the same. Sundry creditors are up by roughly £40,000, which figure includes every class of creditor, whether on taxation account, capital account or general trading account. The balance on the profit and loss account brought forward from last year of roughly £12,000 requires to have added to it the net profit for the year of £16,000 odd, making a total of £28,000 or thereabouts, from which requires to be deducted the preference share dividends for the year ended June 30, 1942, leaving a final balance of £25,358, from which sum you will observe it is proposed that a dividend on the ordinary shares at the rate of 7½ per cent. less tax shall be paid, the net cost thereof to the liquid finances of the Company being £3,750, and that there shall be transferred to the general reserve account the sum of £10,000, leaving a balance to be carried forward to next year of £11,608. It is also further proposed that the item appearing in the Balance Sheet under "taxation reserve account" shall be embodied in the general reserve account in future, for which object a formal resolution will be submitted to this meeting.

"On the assets side of the Balance Sheet, goodwill remains as hitherto. Freehold land and buildings have gone up by some £8,000, plant and machinery is up by £12,000 odd, those items representing the important fixed assets of your Company, and you will observe that a new item appears in relation to a subsidiary company, to which matter I have referred earlier. The stocks on hand are down quite appreciably since last year, when we had considerable volumes of stock unable to be completed and despatched due to lack of plant for finishing purposes; this, however, has been remedied during the year and the material despatched.

"Debtors are up by roughly £10,000, and the liquid cash position is better by roughly £20,000, but it must not be overlooked that the creditors already referred to are up by approximately £40,000.

Management's Share

"While dealing with the matter of service, there is a very vitally important section of the community who, more often than not, do not secure their fair share of thanks for the work they are doing; there is a sort of idea that 'war workers' are essentially people who operate machines and processes mainly through the agency of physical force, but before that section can pull their weight effectively there has got to be research work, planning, designing, testing and other invaluable preliminaries carried out which employ only the agency of mental effort. So often reference to this important section of the work of fighting this war is dealt with with casual reference to 'Management,' and I trust that those whose utterances in public carry weight will do more in the future to see to it that those who perform this vital brain work have thanks that is properly due to them, for in so many cases they are much too retiring to make their presence effectively felt."

AMALGAMATION OF ENAMELLING FIRMS

STEWART & GRAY, LIMITED

The amalgamation of the enamelling firms of J. F. Stewart & Company, Limited, and J. Gray & Sons, Limited, brings together two of the most prominent companies in the enamelling industry, both having contributed considerably to the advancement of vitreous porcelain enamelling in Great Britain and abroad. J. F. Stewart & Company, Limited, commenced business in 1922 with the manufacture and sale of bath dusting enamels and jobbing enamelling work, and it is interesting to record that this jobbing work, in addition to a wide range of sanitary fittings and brackets, and the then popular "Escol" bath taps, included also the enamelling of electric fires, all of which were enamelled by the dusting process.

The company of J. Gray & Sons, Limited, was a unique formation, as it was the first firm of enamelling engineers in Great Britain, and in collaboration with J. F. Stewart & Company, Limited, undertook the sale and servicing of "Escol" enamels, the trade name of the enamels manufactured by them. As a result of this collaboration, the two companies became very closely allied, J. Gray & Sons, Limited, undertaking the installation of enamelling plants throughout the country and in many places abroad, these being continually under their supervision, and serviced with "Escol" enamels.

This continued association made their formal amalgamation inevitable, and the new company was inaugurated in September, 1942, both the old companies being voluntarily liquidated. The new company—Stewart & Gray, Limited—commenced operation on November 1, 1942, with the following administrative staff:—Mr. W. Thomason, F.I.C., chairman; Mr. J. W. G. Pedder, F.L.A.A., director-secretary; Mr. R. J. Thomason, B.A., A.I.C., technical director (on active service); Mr. J. T. Gray and Mr. N. F. Parker, M.A., A.I.C., managing directors; Mr. J. H. Gray, A.I.Mech.E., director-acting works manager; and Mr. A. G. Gray, A.M.Inst.B.E., production manager.

PERSONAL

MR. F. A. SPENCE BROWN has joined the board of Johnson Matthey & Company, Limited.

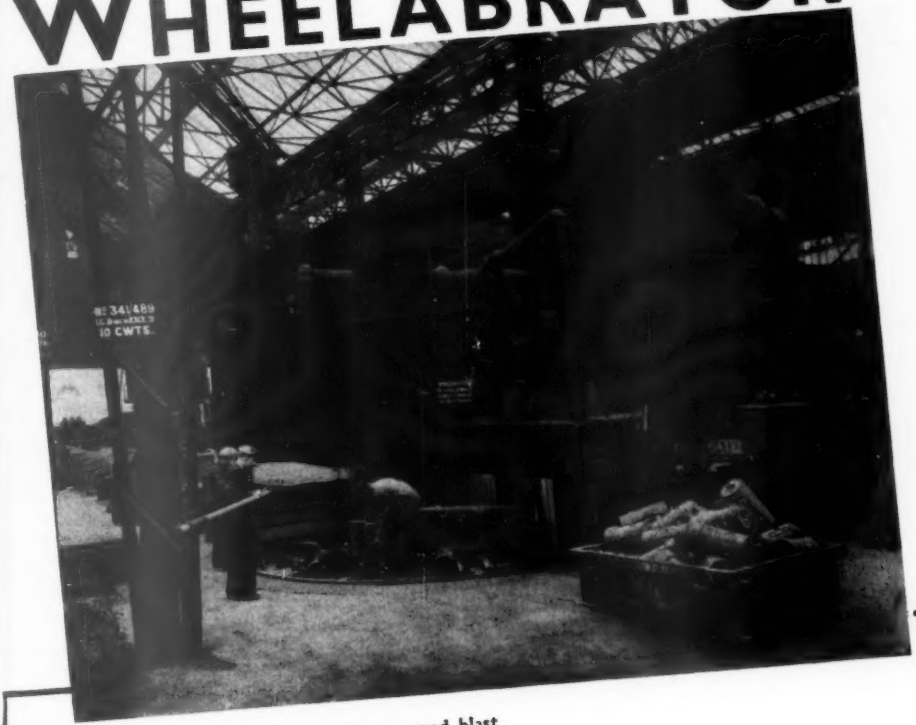
MR. J. W. GAUNT, managing director of W. & J. Lawley, Limited, Britannia Foundry, West Bromwich, has just completed 50 years with the firm, which he joined as an office boy.

COL. C. A. B. LINDOP, J.P., managing director of H. W. Lindop & Sons, Limited, malleable iron founders, Walsall, has been appointed a deputy lieutenant for Staffordshire.

Will

Toosy, F. S., of Stourport, commercial manager of the Midland branch of Baldwins, Limited ... £4,633

WHEELABRATOR



A rotary table plant incorporating a sand blast room, specially designed for cleaning large-cored work. The pieces pass through the rubber curtain into the Wheelabrator cabinet, where they are automatically cleaned, then into the sand blast room on the left for final touching up by hand of the more inaccessible parts.

More and more firms are realising that they cannot cope with their output without the help of an Airless Wheelabrator cleaning plant. The Tum Blast is of course the most usual choice, but the above installation is only one of the many special applications of the Wheelabrator principle, designed by our engineers. Write for catalogues.

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NEWS IN BRIEF

MR. C. E. PORTER, of Stamford, has completed sixty years' service with Blackstone & Company, Limited. For the past 23 years he has been engaged on inspecting and passing out the crankshafts used in the firm's engines.

AN ORDER has been made providing for the registration of producers of any material specified in the Schedule to the Control of Stone Slag, and Lime Order, 1941. No producer will be allowed to continue operations at any works after April 1 unless he holds a certificate.

SMITH & WELLSTOOD, LIMITED, stove, range, boiler and grate makers, of Bonnybridge, Stirlingshire, have a fine record in their factory savings effort. Started in 1929, this scheme has been developed and the original members have now the sum of £19,635 to their credit. The scheme carries with it a free life assurance as an added incentive to saving.

THE NORTH-EAST COAST INSTITUTION of Engineers and Shipbuilders has received a donation of £1,000 to the benevolent fund from Mrs. Keller, widow of the late Mr. K. O. Keller, vice-president of the Institution and founder of the fund. It has been decided that the donation shall be permanently recorded in the accounts of the fund as the Keller Memorial Gift.

THE DECEMBER ISSUE of the "Nickel Bulletin" includes abstracts of American origin dealing with the influence of nickel on copper and on iron, electropolishing of steel, machinability tests on alloy steel, and the effect of controlled atmospheres on electric furnace alloys. Copies of the "Bulletin" may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

OBITUARY

MR. FRANK W. HARBORD, C.B.E., the well-known consulting metallurgist, senior partner in the firm of Riley, Harbord & Law, died recently at his home at Englefield Green. Mr. Harbord had a distinguished career and earned an international reputation for the skill and meticulous care of investigations carried out for the Indian and various other governments. During the last war he was honorary adviser in metallurgy to the Ministry of Munitions. He was trained at the Royal School of Mines, becoming an Associate; he was a Fellow of the Institute of Chemistry and a Fellow of the Chemical Society. In 1927-28 he was president of the Iron and Steel Institute and he was also a past-president of the Institution of Mining and Metallurgy. His name became known first of all to a younger generation of metallurgists through his volumes, "The Metallurgy of Iron and Steel," which were a standard work of reference for many years. He also edited and revised the second edition of Sir W. R. Austen's "Introduction to the Study of Metallurgy." He had been in private practice as a consulting metallurgist since 1905.

IRON AND STEEL CONTROL

At the request of the Ministry of Supply, Sir Charles Wright has been appointed Acting Controller of Iron and Steel in place of Sir John Duncanson, who has undergone an operation.

Mr. Kenneth Lampson has been appointed Assistant Controller, Iron and Steel Supplies Department, Iron and Steel Control, Ministry of Supply. Mr. Lampson has been with the Iron and Steel Control since May, 1940, when he was seconded by Dorman, Long & Company, Limited, to act as liaison between the Control and the French Armaments Mission. After the French collapse he took charge of the export side and for a considerable period was responsible for the operations of B.T.5 in conjunction with the Board of Trade. He was later, following the change of policy which led to a great reduction in exports, appointed Assistant to the Deputy-Controller in charge of Iron and Steel Supplies. Since this time he has been closely associated with Sir John Duncanson, Controller, and Mr. George Briggs, Deputy-Controller. Mr. Lampson took up his new position on January 1.

Mr. F. S. Towle has relinquished his appointment as Director for Iron and Steel Scrap Supplies. He will be succeeded by Mr. H. W. Secker, hitherto area representative in Sheffield. Mr. J. McCallum succeeds Mr. A. J. Wainford as area representative for the North-East Coast.

SIMPLIFICATION OF HEARTH FURNITURE

A specification for hearth furniture has been issued by the British Standards Institution at the request of the Board of Trade. It aims at the production during wartime of the minimum number of types and sizes of hearth furniture. The items included cover fireguards, pokers, shovels, tongs, trivets and frets, and it is understood that manufacture will be restricted to these items, which must comply with the dimensions and materials laid down in the specification.

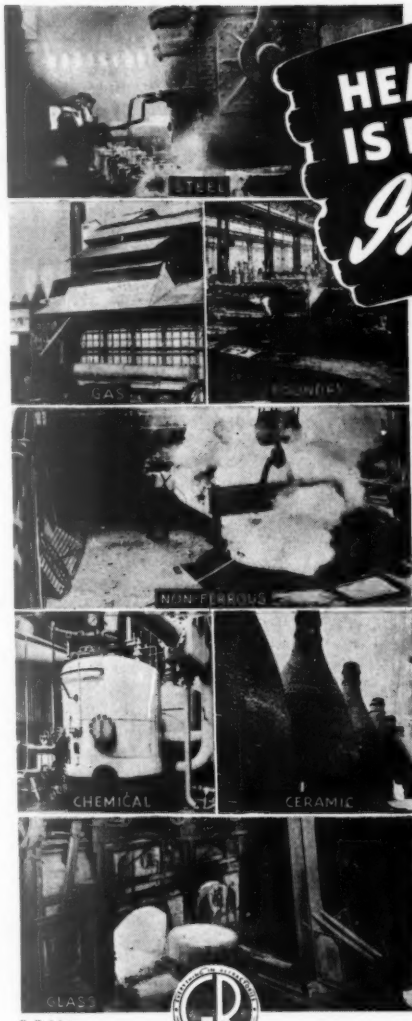
Copies of the specification (BS/BOT 16) may be obtained from the British Standards Institution, 28, Victoria Street, Westminster, price 6d. net.

RAW MATERIALS FROM NORTH AFRICA

Allocation of the raw materials available to the United Nations in French North Africa is announced from Washington by the Combined Raw Materials Board. The allocation is made with the co-operation of the French authorities in North Africa. After meeting local needs supplies available for export will go to the two countries on the following basis:—

United Kingdom.—Iron ore and pyrites, phosphate rock and phosphates, zinc ore, and concentrates of lead bullion and ore.

United States.—Manganese, cobalt ore, and cork.



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COMPANY NEWS

(Figures for previous year in brackets.)

Aeroplane & Motor Aluminium Castings—Interim dividend of 10% (15% for full year).

Lake & Elliot—Profit to July 31 last, £31,224 (£29,485); ordinary dividend of 20% (same); forward, £52,215 (£45,855).

Tarran Industries—Net trading profit for the year to September 30 last, £36,088 (£70,647); dividend of 10% (same); forward, £54,423 (£63,359).

Hale & Hale (Tipton)—Trading profit to August 4 last, £21,114 (£20,603); net profit, after fees and depreciation, £16,319 (£15,025); ordinary dividend of 7½% (same), £3,750; preference dividend, £2,750; to reserve, £10,000; forward, £11,609 (£11,789).

Birfield Industries—Dividends from subsidiaries in the year ended November 30, £75,597 (£70,330); preference dividend, £27,900 (£30,476); capital redemption, £10,000; ordinary dividend of 12½% (same), £16,563; to reserve, £10,000 (nil); forward, £43,347.

Joshua Bigwood & Son—Trading profit for the year to September 30, 1942, £81,805 (£42,782); depreciation, £7,854 (£4,527); war damage contribution, £1,265 (£1,426); tax provision, £61,000 (£27,000); final ordinary dividend of 5% (same); forward, £4,439 (£2,043).

John Bedford & Sons—Profit for the year to September 30 last, after charging war damage contributions and depreciation, £58,794 (£34,033); income-tax and E.P.T., £47,285 (£23,892); dividend on the ordinary capital of 10% (same); preference dividend, £2,500; forward, £6,355 (£5,846).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

W. M. Engineering Company—£1,000. D. Hickson, 32, Rosebery Vale, Ruislip, Middlesex, subscriber.

Gwent Engineering Company—£1,000. J. W. Kinsman, 45, Cathedral Road, Cardiff, and J. C. Robinson.

Birchall Aluminium Casting Company, 138, Edward Road, Balsall Heath, Birmingham—£2,000. H. G. and L. Birchley.

A. S. Blackman (Precision Engineers), 45, Chancery Lane, London, W.C.2—£2,500. A. S. Blackman and B. B. Babain.

Comet Jig & Tool Company, 21, Colindale Avenue, Colindale, London, N.W.9—£1,000. F. J. A. and C. H. P. Vivian.

Torrid Arc Welding Company, Balfour House, Finsbury Pavement, London, E.C.2—£1,000. J. R. Thomas and S. T. Roberts.

APPROXIMATELY 3,000,000 tons of iron and steel scrap has been collected in the American scrap campaign. Those directing the drive believe final figures may show nearly twice this amount.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

549,238 PROCTOR, W. F., and WEBB, G. W. Methods of and means for the casting and extrusion of metals.

549,273. BONNYBRIDGE SILICA & FIRECLAY COMPANY, LIMITED, and MCBRYDE, W. Muffle kilns.

549,327 BIRMINGHAM ALUMINIUM CASTING (1903) COMPANY, LIMITED, and PRITCHARD, P. Casting of metals.

549,330 CROWN CORK & SEAL COMPANY, INC. Sheet-metal containers.

549,343 SEARLE, R., BRIGINSHAW, F. F., and GARRAWAY, A. Cold storage of light alloy sheets after heat-treatment.

549,429 HALL STREET METAL ROLLING COMPANY, LIMITED, and WHITE, W. J. Rotary metal shearing machines.

549,450 GIBBONS BROS., LIMITED, and DEWIDELS, J. Heating and annealing furnaces.

549,479 NORTHERN ALUMINIUM COMPANY, LIMITED, and SHOWELL, G. D. Machines for opening and tailing material, such as sheet metal in coiled form.

549,483 WHITEHEAD, E. J. Composite metal castings.

548,493 MONMORE GREEN ROLLING MILLS COMPANY (1924), LIMITED, and PICKEN, E. M. Dies used for forming butt-welded metal tubes from metal strip.

548,620-1-2 FAIRWEATHER, H. G. C. (National Smelting Company). Aluminium base alloys.

548,630 BLOUNT, B. D. H., and BALLARD, W. E. Metal spraying.

548,639 NORTON & COMPANY, LIMITED, SIR J. F., and NORTON, D. G. Machines for flattening or straightening of metal strips and sections.

548,646 JACOBSSON, W. J. Method and apparatus for surfacing metal bodies.

549,497 HUME, W. R., and HUME PIPE COMPANY (AUSTRALIA), LIMITED. Centrifugal moulding of concrete pipes and the like.

549,501 LOWE, J. S. Heat-treatment furnaces.

549,553 O'SHEA, W. E. Die-casting apparatus.

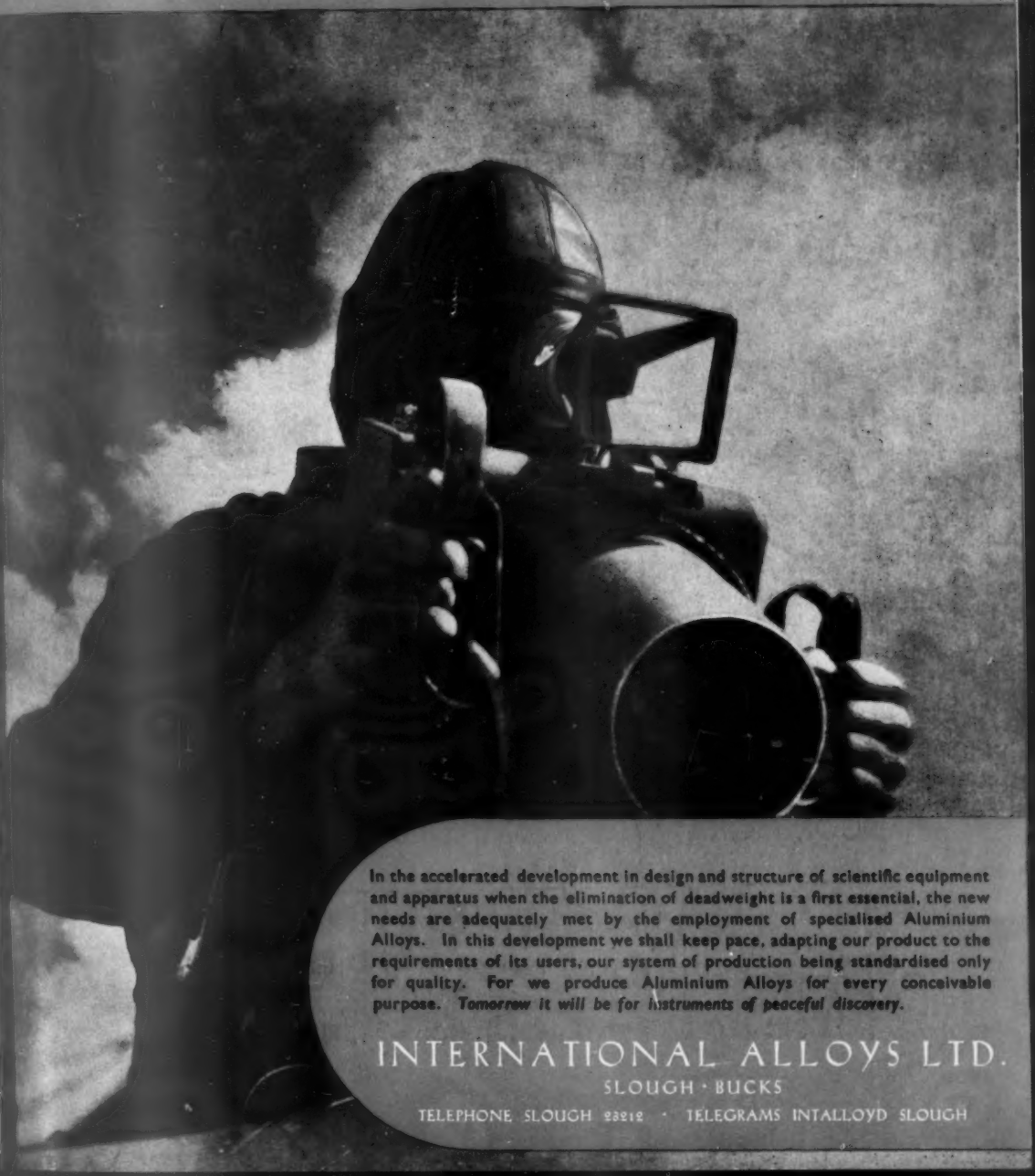
549,557 SANSOME, R. D. Method of and means for covering the exposed surfaces of cast metal goods.

BROOM & WADE CAPITAL INCREASE

The directors of Broom & Wade, Limited, of High Wycombe, Bucks, manufacturers of air compressors, pneumatic tools, etc., recommend that the capital of the company be increased to £400,000 by the creation of 440,000 new 5s. ordinary shares.

AN IRON FETTLER who at Halifax pleaded guilty to persistent lateness, was fined £10. He had been warned by the works committee for lateness and in the period January 1 to September 17 lost an average of 12 hours a week.

APPLICABILITY



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